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ORIGINAL RESEARCH

RUNNING INJURY DEVELOPMENT: THE ATTITUDES OF MIDDLE- AND LONG-DISTANCE RUNNERS AND THEIR COACHES

Karen Krogh Johansen, MSc[1]
Adam Hulme, MSc[2]
Camma Damsted, MSc[1]
Daniel Ramskov, MSc[1,3]
Rasmus Oestergaard Nielsen, PhD[1]

ABSTRACT

Background: Behavioral science methods have rarely been used in running injury research. Therefore, the attitudes amongst runners and their coaches regarding factors leading to running injuries warrants formal investigation.

Purpose: To investigate the attitudes of middle- and long-distance runners able to compete in national championships and their coaches about factors associated with running injury development.

Methods: A link to an online survey was distributed to middle- and long-distance runners and their coaches across 25 Danish Athletics Clubs. The main research question was: "Which factors do you believe influence the risk of running injuries?". In response to this question, the athletes and coaches had to click "Yes" or "No" to 19 predefined factors. In addition, they had the possibility to submit a free-text response.

Results: A total of 68 athletes and 19 coaches were included in the study. A majority of the athletes (76% [95%CI: 66%; 86%]) and coaches (79% [95%CI: 61%; 97%]) reported "Ignoring pain" as a risk factor for running injury. A majority of the coaches reported "Reduced muscle strength" (79% [95%CI: 61%; 97%]) and "high running distance" (74% [95%CI: 54%; 94%]) to be associated with injury, while half of the runners found "insufficient recovery between running sessions" (53% [95%CI: 47%; 71%]) important.

Conclusion: Runners and their coaches emphasize ignoring pain as a factor associated with injury development. The question remains how much running, if any at all, runners having slight symptoms or mild pain, are able to tolerate before these symptoms develop into a running-related injury.

Level of Evidence: 3b

Keywords: Attitudes, coach, etiology, running injury

[1] Department of Public Health, Section of Sport Science, Aarhus University, DK-8000 Aarhus
[2] Australian Collaboration for Research into Injury in Sports and its Prevention (ACRISP), Federation University Australia, SMB Campus, PO Box 663, Ballarat, VIC, 3353, Australia
[3] University College Northern Denmark, Department of Physiotherapy, Aalborg, Denmark

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CORRESPONDING AUTHOR
Rasmus Oestergaard Nielsen
Department of Public Health, Section of Sport Science, Faculty of Health Science, Aarhus University
Dalgas Avenue 4, room 438, DK-8000 Aarhus C.
Denmark
E-mail: roen@ph.au.dk

INTRODUCTION

The middle- and long-distance (M/L) running disciplines are a major part of organized athletics around the world.[1-3] M/L running events range from 800-meter track races to marathon running as well as cross-country. Indeed, elite runners who have high training loads can exceed 35 hours per week of running prior to a given major championship.[2,4] Intense training regimes and multiple competitive events across the sporting calendar can place a considerable level of stress on the athlete's body. Consequently, runners competing at a high level are vulnerable to musculoskeletal injuries[1-3] that can be serious enough to debilitate those afflicted.[5] Across the disciplines in athletics, authors have reported an injury prevalence proportion of 43-76% among the athletes,[2,6] whereas studies investigating the incidence of injuries during an entire athletics season reported that two out of three athletes sustain injuries on an annual basis.[2,7]

M/L runners and their coaches strive to identify interventions to reduce running-related injuries (RRI's) despite a limited evidence-based knowledge to support their efforts.[8] Since effective intervention strategies build on etiological evidence,[9] the first scientific hurdle to clear is to increase the knowledge about injury etiology. Since the 1970s, scientific interest around the development of RRI's has steadily increased and considerable efforts have been made to shed light on these injuries.[10] Notwithstanding the identification of few statistically significant risk and protective factors for running injury amongst M/L runners, such as a history or previous injury,[4] little overall progress about the etiology of RRI's has been made to date.[2,11]

The routine application of traditional epidemiologic approaches has been, and will remain to be, a necessary step for better understanding the etiology of RRI´s. However, the use of original, complementary and alternative research approaches is also required alongside common practice if the complex origins of distance running injury are to be realized.[12-14] Given that quantitative studies have largely dominated the RRI literature, there is a need for more qualitative research approaches that directly include end-users and other key members of 'the distance running system'.[12] Qualitative methodologies in the context of healthcare research presents many advantages if deemed appropriate given the circumstances and specific research questions asked.[15,16] For example, value-laden questions, complex health-related phenomena not easily reducible to their component parts, and particular research outcomes that are partly characterized by social and behavioral influences are well suited to qualitative research approaches.[17] Ascertaining certain data and information from middle- and long distance runners and their coaches is essential for appreciating participants' values, principles and motivations underpinning certain actions and behaviors.[18] Not only can qualitative research elucidate runners' attitudes and experiences about their own psychosocial dispositions preceding injury development,[19,20] it also has the potential to refine or influence existing reductionist approaches that characterize traditional epidemiological inquiry.

In the RRI literature, researchers have explored the attitudes and opinions regarding factors associated with running injury development. Saragiotto et al. investigated the attitudes of recreational runners on risk factors for running injury.[21] These runners mainly attributed injury to training, running shoe choice, and exceeding the body´s limits. In another study among health professionals and coaches, training factors such as excessive training was found to be important risk factors.[18] Finally, van Wilgen et al. investigated the attitudes among coaches and athletes from various sports.[22] They found that factors related to training, situation and behavior were associated with injuries. However, only one of the coaches included in the study worked directly with runners. Based on this, there is a lack of empirical knowledge regarding the attitudes of M/L distance runners competing in national championships and their coaches on risk factors for running injury. Therefore, the purpose of the present study was to investigate the attitudes of M/L distance runners able to compete in national championships and their coaches about factors associated with running injury development.

METHODS

The study was designed as a survey-based study. The study is observational and therefore needs no

permission from the system of research ethics committees according to the Danish Act on Research of Health Projects, Section 14, no. 2. Based on this, the study was conducted according to Danish law. Since no personal-identifiable information was collected, the Danish Data Protection Agency waived the request for approval, because participants indicated informed consent by clicking on a yes-button in a web-based questionnaire, and since data collections without identifiable data do not need approval in Denmark.

Recruitment and data collection

Data was collected in November and December 2015. The study population was M/L distance runners and their coaches who were members of a running club registered in the Danish Athletic Federation. This enabled the runners to compete in National Championships (road races, cross-country and track) and coaches to work with runners competing in National Championships. E-mails were distributed to 25 of 69 Danish Athletic Clubs registered by the Danish Athletic Federation (http://www.atletikogmotion.dk/). The 25 clubs were chosen since these clubs, according to athletic-specific homepages (http://www.statletik.dk/ and http://daf.sportstiming.dk/), had members participating in National Championships (e.g. 10 kilometer road running, 800 to 10.000 meter track, and the marathon distance) and/or local athletic events (e.g. "Bane turneringen" and Aarhus Nordic Challenge) in the prior year. It is the authors´ best guess that there were approximately 500 runners affiliated with the 25 included running clubs. The exact number was unknown given that participant recruitment occurred through contact with staff members and running coaches. This was because the Danish Athletics Federation does not have a record of its members, and so it was not possible to extract information from a known database. In the e-mail, information about the study was provided and the coaches were encouraged to respond to a coach-specific survey, whilst the runners were encouraged to respond to an athlete-specific survey through a link to a web-based survey. In addition to the e-mails, information about the study and links to surveys were posted via club-specific social media groups (e.g. Facebook). In the event that no responses were submitted one week after the first contact, a reminder-e-mail was sent. After an additional week of no response, the chairman / chairwomen from the club was contacted by telephone and encouraged to inform the members about the study. Runners eligible for inclusion were: (i) older than 17 and younger than 51 years of age; and, (ii) athletes training at least 40 km per week. Coaches eligible for inclusion were: (i) Above the age of 18; and, (ii) an active coach for one or more M/L distance runners competing at an athletic level. Runners or coaches under the age of 18 were excluded since parental consent was needed in case runners and coaches below 18 years were to participate.

Survey

Both surveys were written in Danish. In October 2015, these surveys were pilot tested amongst four runners and three coaches from one athletic club. The final surveys contained 26 questions including: (i) demographic information (age, gender, weight, height); (ii) training characteristics (e.g. average running distance, number of high-intensive sessions, running frequency per week years as active athletic runner); (iii) injury status (currently injured, current- and previous injury, previously injured, never had an injury); and, (iv) attitudes regarding injury occurrence. A RRI was defined as "a prolonged pain, which leads the runners to reduce training or competition for at least three weeks".

The main question addressed by the survey was: "*Which factors do you believe influence running injury risk?*". For this question, the coach or athlete was presented with a list of 19 items (Table 1). For each item, they were asked to answer, by clicking a yes or no button, if they believed that a given factor influenced RRI risk. These 19 items (divided in to four categories: personal factors, behavior, shoes, and training-related factors) were chosen based on the findings from recent (at the time) systematic reviews [23,24] and attitudes amongst recreational runners [21]. In addition, the responders had the possibility to click "other" and add additional items.

Secondary questions were presented to investigate which types of RRIs the runners and coaches felt were most common. Furthermore, to increase the insight on attitudes regarding advice which could lead to running injury prevention, the coaches and athletes were asked in an open-ended question:

Table 1. *Possible answers to: "Which factors do you believe influence running injury risk?" In this question, the coach or runner was presented with a list of 19 items. For each item, they were asked to answer by clicking yes or no on the survey, if they believed that particular factor influenced running injury risk. In addition, the respondents were able to add other reasons.*

Item #	Description
1	High running distance (too many kilometers)
2	Many interval- or tempo sessions
3	Insufficient recovery between running sessions
4	Fast progression in distance and/or intensity
5	Many competitions
6	Reduced muscle strength
7	Running style (e.g. fore-foot-, mid-foot-, rear foot strike pattern)
8	Age
9	Psychological stress
10	Running experience
11	Low energy availability (too little food in relation to running volume)
12	Running shoes which do not fit foot posture (e.g. neutral, pronation)
13	Worn down running shoes
14	Low cushioning level in running shoes
15	No or little warm-up
16	Other sports than running
17	Running too much on a particular surface (e.g. asphalt, tartan, terrain)
18	Ignoring pain
19	Previous injury
20	Other

"*How would you advise a runner to act in order to prevent injuries?*"

Statistics

Continuous data are presented as mean and standard deviation (SD) if they were normally distributed and as median and inter-quartile range if they did not follow a normal distribution. Categorical data are presented as numbers (n) and proportion (%). Differences in the opinions between coaches and athletes were analyzed using students' t-test for continuous data and as chi-square test for categorical variables. Differences were considered statistically significant at $p < 0.05$.

RESULTS

A total of 83 athletes (45 males, 37 females) representing 11 of the 25 invited clubs (44%) completed the survey. However, 15 (18%) of these were excluded, as they did not meet the inclusion criteria, due to not meeting minimum age requirements (n = 4, 27%), low training volume (n = 6, 40%), or missing several required questions and misreported answers (n = 5, 33%). Eventually, 68 athletes were included in the study (Table 2). The demographic characteristics of the 19 coaches representing 11 clubs (44%) are presented in Table 3. The attitudes amongst M/L runners and their coaches, as well as factors on which they agree and disagree in relation to injury risk, are presented in Table 4. According to both M/L runners and coaches, the injury types believed to be most common were medial tibial stress syndrome, Achilles tendinopathy and iliotibial band syndrome.

Regarding the open-ended question "How would you advise a runner to act in order to prevent injuries?", the most commonly advised intervention was strength training as advised by nine athletes (13%) and two coaches (11%). Alternative training (e.g. deep-water running, cross training, swimming) was advised by seven athletes (10%). Next, eight athletes (11%) and two coaches (11%) advised avoiding increasing the intensity and/or volume too fast, and finally three athletes (4%) and two coaches (11%) emphasized the importance of communication between the coach, physiotherapist, and athlete.

Table 2. *Injury history, demographic- training-related characteristics of the included M/L athletes. Values represent mean ± SD or number and proportion. [a] = data presented as mean and standard deviation. [b] = data reported as median and interquartile range since data was not normally distributed.*

	Males (n=41)	Females (n=27)	All (n=68)
Age, years[b]	33 (25; 39)	26 (21; 34)	30 (23.5; 38)
Height, cm[a]	180.4 ± 5.5	168.6 ± 6.2	175.8 ± 8.2
Weight, kg[a]	68.7 ± 6.0	56.9 ± 6.1	64.0 ± 8.3
Weekly running distance, km/week[b]	80 (70; 90)	65 (45; 80)	75 (60; 90)
Weekly frequency, n[a]	7.5 ± 2.3	7.0 ± 2.1	7.3 ± 2.2
Weekly high-intensity sessions, n[a]	2.6 ± 0.8	2.4 ± 0.9	2.5 ± 0.9
Experience in athletics, years[b]	6 (4; 12)	6 (3; 10)	6 (4; 12)
Preferred distance			
Middle-distance, n (%)	13 (32)	5 (18.5)	18 (26.5)
Long distance, n (%)	28 (68)	22 (81.5)	50 (73.5)
Injury status			
Currently injured, n (%)	8 (20)	4 (15)	12 (18)
Current- and previous injury, n (%)	4 (10)	3 (11)	7 (10)
Previous injury, n (%)	26 (63)	18 (67)	44 (65)
Never had an injury, n (%)	3 (7)	2 (7)	5 (7)

Table 3. *Demographic- and coaching experience of the included coaches. Values represent mean ± SD or number and proportion*

Variable	All (n=19)
Age, years	37,2 ± 10,6
Gender male, n (%)	15 (79 %)
Experience as coach, years	8,9

DISCUSSION

This is the first study to examine the attitudes of M/L distance runners able to compete in National Championships and their coaches regarding their attitudes regarding risk factors for RRI. Runners reported ignoring pain, insufficient recovery between running sessions, lack of strength, training experience and previous injury to be main risk factors, while the coaches reported ignoring pain, lack of strength, high training volume, insufficient recovery between running sessions, and stress to be the most important risk factors for running injury.

According to most runners and coaches, ignoring pain stands out as the main risk factor associated with injury development. This is interesting since Jacobsson et al., in a study of Swedish elite athletes, found half of the injured athletes experienced pain one to two weeks before injury was reported.[2] Attention towards early symptoms and pain management might be crucial in running injury prevention for this population of runners. In particular, amongst those with a "no pain, no gain" attitude, since Saragiotto et al. found coaches and health professionals to report increased risk of injury development amongst such types of athletes.[18]

A total of 79% of the coaches and 44% of the runners reported reduced strength as another risk factor associated with increased injury risk. This finding is in accordance with the attitudes among recreational runners who also reported "lack of strength" as a risk factor for injury.[21] A recently published systematic review on risk factors for RRI found only few published studies examining the role of strength-based resistance training on injury development.[10] Fortunately, more scientific focus on the role of strength training on injury development is occurring.[25]

In epidemiological studies,[10] conflicting results exist regarding the role of running frequency and risk of RRI. In the present study, insufficient recovery between running sessions was highlighted as impor-

Table 4. *Attitudes among middle- and long (M/L) distance runners and their coaches on risk factors for running-related injury. P-value is based on a test for similar proportions between runners and coaches. CI = Confidence interval. Shoe and foot posture = Running in running shoes, which do not fit foot posture (neutral, pronation). Fast progression = Fast progression in distance and/or intensity. Running style = striking at fore-foot, mid-foot and/or rear-foot. Insufficient recovery = short time between running sessions.*

	M/L Runners (n=68)		Coaches (n=19)		P-value
	Proportion	95% CI	Proportion	95% CI	
Personal factors					
Age	15 %	6.3, 23.1	42 %	19.9, 64.3	0.01
Psychological stress	29 %	18.6, 40.2	53 %	30.2, 75.1	0.06
Previous injury	43 %	31.2, 54.8	27 %	15.3, 58.7	0.63
Behavior					
Ignoring pain	76 %	65.8, 86.1	79 %	60.7, 97.3	0.78
Too low energy-intake	34 %	22.7, 45.2	37 %	15.2, 58.7	0.81
Running shoes					
Worn down running shoes	26 %	15.6, 36.4	26 %	6.2., 45.7	0.99
Low cushioning level	12 %	4.2, 19.7	11 %	20.8, 42.8	0.99
Shoe and foot posture	24 %	13.8, 34.1	11 %	3.1, 25.1	0.14
Training-related factors					
Fast progression	15 %	6.5, 23.4	26 %	6.2, 45.7	0.31
High running distance	13 %	5.0, 21.0	74 %	54.2, 93.7	0.01
Many interval/tempo-sessions	9 %	2.1, 15.8	26 %	6.2, 45.7	0.11
Many competitions	4 %	0.1, 9.3	16 %	0.1, 32.2	0.19
Running experience	44 %	32.3, 55.8	42 %	19.8, 64.1	0.58
Reduced muscle strength	44 %	32.3, 55.8	79 %	60.7, 97.3	0.01
Lack of warm up	29 %	18.2, 39.8	32 %	11, 53	0.80
Insufficient recovery	59 %	47.3, 71	68 %	47, 89	0.46
Running style	16 %	7.3, 24.7	27 %	15.3, 58.7	0.08
Surface	37 %	25.5, 48.4	42 %	19.8, 64.1	0.69
Other training	9 %	2.1, 15.8	11 %	3.1, 25.1	0.80
Other					
Other	3 %	1.1, 7.1	26 %	6.2, 45.7	0.03

tant by 59% of the runners and 68% of the coaches. Still, there is little to no scientific agreement regarding the number of running sessions acceptable for different runners of different shapes and sizes. Most likely, runners with a high experience who have been accustomed to many weekly running sessions might not be as prone to injury compared with low experience runners running a few sessions per week and then suddenly changing to more sessions per week.[26]

Running "too much, too soon" has been discussed in the scientific literature,[11,23,27] since overuse-related injuries, theoretically, are a result of training errors.[28] Interestingly, the great interest amongst scientists on the deleterious role of excessive running[29,30] does not seem to reflect the attitudes amongst the runners, since below 15% found excessive training distance and/or intensity to be risk factors for injury. Conversely, 74% of the coaches found excessive distance as being associated with injury risk. Clearly, this shows a gap in attitudes between coaches on one side and the athletes on the other. Interestingly, only two coaches advised avoiding increasing the intensity and/or volume too fast in order to prevent injuries. This could lead to the assumption, that

coaches are unfamiliar with, or do not prioritize, the proposed link between risk factors for injury and targets for intervention strategies. If the prevention is better made by knowledge about risk factors,[9] more coaches should pay attention to excessive training avoidance and pain management as preventive strategies. Unfortunately, the evidence-base for determining the appropriate dose of running for runners with different characteristics is non-existent. More studies are needed to identify training schedules associated with a low injury risk for different types of runners.

The study has its limitations since the survey could have been more nuanced providing respondents with the possibility to address each question using a Likert scale ranging from "no importance" to "high importance" rather than the dichotomized approach used in the present study. Unfortunately, it was not possible to create a Likert scale in the web-based system used to set-up the survey. Therefore, a dichotomized solution was used. In addition, the sample size may be a limitation since the beliefs of the 68 runners included might not reflect the belief of the approximately 500 runners (14%) who were members of the 25 clubs, which were contacted. Consequently, the proportions reported in this article may be over- and/or underestimated because of selection problems. In addition, the choice of injury definition in the present study might be considered as a limitation, since usage of the consensus-based definition of running injury proposed by Yamato et al.[31] could reveal other results than those presented.

CONCLUSIONS

The primary purpose of the present study was to investigate the attitudes of M/L distance runners and their coaches about factors associated with RRI development. M/L distance runners and their coaches report "ignoring pain" as a major risk factor for running injury development, while a majority of the coaches reported "reduced muscle strength" and "high running distance" to be associated with injury. The need to further investigate the athlete's psychological profile in relation to running-related injury development is warranted based on the novel results generated in this study. In and of itself, 'ignoring pain' is not particularly informative when thinking about injury prevention solutions. However, it is more than likely a proxy indication for another exposure, since behavior itself is unable to cause running-related injury. An athlete needs to run to sustain an injury. Therefore, the proxy variable might be the amount of running participation that might be readily quantifiable and meaningful in practical terms. The questions remains how much running, if any at all, runners having slight symptoms or mild pain, are able to tolerate before these symptoms develop into a RRI.

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